APPARATUS AND METHOD FOR PRINTING IMAGE AND INFORMATION

ASSOCIATED THEREWITH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a technique for printing information associated with a printed image such as date, etc., without degrading the appearance of the image.

2. Description of the Related Art

In photographic records, date information which indicates the date on which a photograph was taken is often important, and sometimes, even valuable. Many cameras using silver salt film have a date function (date impose function), and, when an object is photographed, a date is imposed on the object image in the same frame during the exposure, so that a photograph in which the date overlaps the object image can be obtained. However, since characters representing the date are imposed on the printed image after the development, the appearance of the photograph is significantly degraded.

Due to the development of digital cameras, it has become possible to record and store image information along with associated information such as dates, conditions, names of image files, etc., with a common, standard format. For example, Exchangeable Image Format (Exif), which is common

to various manufacturers, defines the kinds of tags with which the information associated with image data is recorded.

When such associated information is printed on a margin outside an image-printing area, the date information, etc., can be printed without degrading the appearance of the image.

However, in known apparatuses, there are problems in printing the associated information such as the date information, etc., as described below.

That is, since the margin is necessary for printing the date information, the image-printing area must be reduced or print paper having a relatively large size must be used. In addition, since the information is printed on the margin outside the image, the area of the margin must be increased as the amount of information to be printed is increased. Accordingly, it may become impossible to print the image at the maximum allowable print size of the print paper.

In addition, in digital-image-data printing, there are requirements for margin-free printouts as there were in the conventional photograph printing using silver salt film. However, if characters, etc., are imposed on an image in order to satisfy such requirements without changing the paper size, the problems of the conventional photograph printing cannot be solved. More specifically, when the date information, etc., is printed along with an image, characters representing the information must be printed with

vivid colors (for example, orange, yellow, etc.) at a predetermined position in the image-printing area so that they can be seen clearly. As a result, the appearance of the photograph is degraded.

When the margins, which are used for preventing the characters representing a date, etc., from being imposed on the image, cannot be provided, another way to avoid printing the characters on the image is to print them on the backside. However, in such a case, a double-side printing mechanism is required, so that the size of the apparatus is increased and mechanism and control thereof becomes complex. In addition, high costs are incurred and the printing time is increased.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to print information associated with a printed image such as a date, etc., without degrading the appearance of the image or using a dedicated margin.

According to one aspect of the present invention, a printing apparatus includes an information-obtaining unit which receives the image information and obtains the information associated therewith, the associated information including attached information that is read out in relation to the image information or added information that is input or selected by an input/operation unit in accordance with

the image information; a printing unit which includes a transfer head which forms the image information on the print medium and which transfers a film sheet onto the image-printed surface of the print medium; and a control unit which controls energy applied to the transfer head and changes a property (for example, glossiness) of the film sheet, thereby forming the associated information on the film sheet as a watermark.

In addition, according to another aspect of the present invention, a printing method includes the steps of receiving the image information and obtaining the information associated therewith, the associated information including attached information that is read out in relation to the image information or added information that is input or selected by input/operation means in accordance with the image information; printing the image information on the print medium; and covering the image-printed surface of the print medium with a film sheet and forming the associated information on the film sheet as a watermark.

Accordingly, the associated information such as date information, etc., can be formed on the film sheet as a watermark. More specifically, the associated information is not visible when a print paper is seen from the front, but can be seen when the print paper is seen at an angle due to the difference in surface glossiness. Thus, the associated

information can be formed without providing a dedicated margin or performing backside printing. In addition, since the associated information does not block the printed image, the appearance of the image is not degraded.

According to the present invention, the following advantages can be obtained:

• Tag information, that is, information stored in Exif files with reference to tags (for example, dates, conditions, names of files, comments of users, copyright display information, etc.), can be formed on the printed image. Since the characters and signals representing the tag information can be formed as a watermark, they are not visible when the a print paper is seen from the front, and can be seen clearly only when the print paper is seen at an angle. Accordingly, the printed image is not degraded and the appearance thereof is ensured.

• The position and orientation of the characters representing the associated information can be selected in accordance with the orientation of the image. Accordingly, the appearance of the associated information can be improved.

• A requirement to form a watermark on a copyrighted image and a requirement of a creator of the image to make his or her work look as attractive as possible can be satisfied at the same time.

• At photographic services (development, printing,

enlargement, etc.), business advertisements can be formed on a laminate layer (film layer) as a watermark. Accordingly, the present invention can be applied generally. In addition, advertising revenue can be expected, so that the printing costs can be reduced.

• In addition to the characters and figures, bar code information, etc., can also be formed on the laminate layer. Accordingly, the images can be more conveniently handled in view of management, storage, selling, etc.

• When a copy machine containing a sensor which is able to detect difference in glossiness from the angle at which the peripheral light is completely reflected, the image can be prevented from being copied.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a circuit block diagram showing a construction of a printing apparatus according to the present invention;

Fig. 2 is a schematic diagram showing a file structure;

Fig. 3 is a graph showing the relationship between energy applied to the transfer head and surface glossiness;

Fig. 4 is a diagram showing the visibility of a region where a watermark is formed;

Fig. 5 is a diagram showing an example of a character string representing information associated with an image;

and

Figs. 6 and 7 are diagrams showing manners in which the orientation and position of associated information are set in accordance with the orientation of an image, where Fig. 6 shows an example of the landscape orientation and Fig. 7 shows an example of the portrait orientation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to a printing apparatus which prints image information and information associated therewith on a print medium. The present invention may be carried out in, for example, the following two modes:

(A) A mode in which the image information and the associated information are processed by a calculating unit such as a computer, etc., and the result is output to a printing unit such as a printer, etc., and is printed out; and

(B) A mode in which the processing of the image information and the associated information and the printing process are performed by a printer or an apparatus such as a camera, etc., having a printing function.

In a system according to Mode (A), the image information is obtained from a recording medium, via a communication line, etc., or is created by an operator, and the calculating unit is used for decompressing an image

pattern, obtaining the associated information, and
performing input/select process, editing process, etc. For
example, when the associated information such as date, etc.,
is handled in the form of an ASCII character string, it must
be converted into bitmap data on the basis of certain font
information. In this system, there is an advantage in that
such a process can be easily performed with an application
software on a computer by using a function provided by an
operating system (OS).

In Mode (B), both the information processing function
and the printing function must be provided to a single
apparatus. Since the apparatus is able to perform all the
processes that are necessary, it can be suitably applied as
a portable apparatus. In addition, since a complex
operation using a keyboard, etc., is not necessary, the
apparatus can be used easily and handily.

According to the present invention, various types print
media including print paper, cards (for example, ID cards to
which pictures for identification are attached), sheets (for
example, sheets of barcode tags), etc., may be used in
accordance with the application.

Fig. 1 is a block diagram showing a major part of a
circuit construction in a printing apparatus according to an
embodiment of the present invention. Although a sublimation
thermal transfer printer will be explained below as an

example of a printing apparatus, the present invention may of course be applied to various types of apparatuses using other print methods.

With reference to Fig. 1, a printing apparatus 1 includes an interface unit 2 for obtaining image information, and receives, for example, data read out from a recording medium or obtained by on-line processing via communication lines. The recording medium may be a magnetic disk, optical disk, a detachable memory medium (for example, card-shaped or stick-shaped semiconductor memory) with which data can be exchanged between a plurality of apparatuses under a common standard, etc. Although an information reproducing unit, a memory control circuit, etc., are necessary for reading out the information from the recording medium, it is assumed herein that they are included in the interface unit 2 in Fig. 1.

The thus obtained image information is transferred to a Central Processing Unit (CPU) 3, an RGB/size converter 4, and a Joint Photographic coding Experts Group (JPEG) decompressor 5 via predetermined signal lines.

When the image information is not compressed, it is processed by the RGB/color converter 4, and red (R), green (G), and blue (B) image data in which the image size is adjusted to a print size are stored in an image memory 6. The image memory 6 serves as an image storage unit and

includes image memory blocks 6R, 6G, and 6B corresponding to red, green, and blue colors, respectively. When the image information is compressed, it is first decompressed by the JPEG decompressor 5 so that brightness data (Y) and color difference data (Cb and Cr) are obtained. Then, the thus obtained data are subjected to the size/RGB conversion process, and are transferred to the image memory 6. A buffer memory 7 is used as a working area for the image conversion process and the decompressing process performed by the RGB/size converter 4 and the JPEG decompressor 5.

The printing apparatus 1 according to the present embodiment has a function to print information associated with the image information. In the descriptions herein, "associated information" includes, for example, the following information:

(I) attached information which is read out in relation to the image information;

(II) added information which is input or selected by an operator in accordance with the image information.

The attached information (I) includes information that is incorporated in a file-format standard (Exif, etc.) as information relevant to the image information, for example, date information (date on which a photograph is taken, date on which image information is created, etc.), copyright display information, etc.

With reference to Fig. 2, a case will be described in which image information and information associated therewith are obtained from an image file based on a file-format standard including the associated information as tag information. The "tag information" refers to data available with reference to tags, that is, identifiers for data fields to each of which a unique number is assigned.

Fig. 2 is a schematic diagram showing a file structure of a compressed Exif file having a compressed thumbnail image.

At the left side in Fig. 2, "SOI" is a marker which shows the position where the file starts, and "APP1", which is an application marker segment, is recorded after "SOI". Compressed data is recorded after various kinds of tables and headers (not shown), and "EOI", which is a marker which shows the end of the data, is recorded at the end.

The "APP1" includes a marker, "Exif IFD" which contains attached information based on Exif, a compressed thumbnail image based on JPEG, etc. The "Exif IFD" includes the above-described tags (Exif Private Tag), types (types of data such as ASCII, bite-type, long-type, etc., indicated by numbers assigned thereto), count (the number of values), etc.

For example, tags corresponding to data relating to date include the following:

- "DateTimeOriginal", which indicates the date and time

at which the original image data is generated. In the case
of a camera, this date is the date and time at which a
picture is taken. Tag number is "9003H" in hexadecimal
number.

  • "DateTimeDigitized", which indicates the date and time
at which the image is digitalized. In the case in which a
file is created at the same time a picture is taken by a
camera, this data is the same as the "DateTimeOriginal".
Tag number is "9004H" in hexadecimal number

  Both of the above-described data are of the ASCII type,
and the length of the character string is 20 bytes including
NULL characters.

  Tags relating to the structure of the image data
include a tag which indicates the orientation of the image
(the tag number is "112H" in hexadecimal number), and
numbers are individually assigned to orientations (or
configurations) of the image.

  In addition, information for displaying copyright or a
copyright holder (for example, a person who took the picture,
edited the image, etc.), a title of the image, a name of the
image file, comments of the user, conditions under which the
picture was taken, characteristics of the image data,
version information, etc., are defined in correspondence
with tag numbers.

  Although non-compressed data files have a structure

different from the compressed data files, the part of the
"Exif IFD", which is recorded after "0th IFD", is basically
the same as described above, and explanations thereof are
thus omitted.

Accordingly, the attached information (I) has various
desirable characteristics in that the information relating
to the image can be recorded in correspondence with
predetermined tags and the recorded information can be
easily used. In addition, the format standard has high
versatility and upward compatibility.

The added information (II) is useful when a user wishes
to input or select data and add the data to the image
information. For example, the added information (II)
includes information which is input by the user by using an
input unit or an operation unit of the printing apparatus,
the information relating to the image data (comments of the
user, etc.). In addition, the added information (II) also
includes information which is selected by the user from
lists of information by using the operation unit, the lists
of information being stored beforehand in a storage unit
(ROM, etc.) of the printing apparatus, read out therefrom,
and shown on a display. Since the operation to input the
information is more complex then the operation to select the
information, the operational mode is preferably designed in
accordance with the application and the usage of the

printing apparatus.

Accordingly, the associated information includes all the information that is to be recorded in relation to the image information, such as, information that the person who took the picture or created the image wishes to print with the image, information that is to be printed with the image for other purposes, etc.

When the associated information is the attached information (I), it is input to the CPU 3 via the interface unit 2 and is processed. When the associated information is the added information (II), it is input to the CPU 3 by an input/operation unit 8 and is processed. The input/operation unit 8 includes an input/select unit 9 (an operation panel, a keyboard, a pointing device, etc.) and an image display 10 (a liquid crystal display, a CRT, etc.) used for displaying the image, command, etc., are provided as a human-machine interface. The input/select unit 9 is also used for inputting, or selecting, the information indicating the orientation of the image, the information being necessary for determining the position and orientation in which the associated information is to be printed in accordance with the printing direction of the image (these processes will be described below).

Accordingly, an information obtaining unit (or an information acquisition unit) is constructed of the

interface unit 2 and the input/operation unit 8. As
described above, the interface unit 2 is used for obtaining
the image information and the attached information which is
read in relation to the image information, and the
input/operation unit 8 is used for obtaining the added
information which is input or selected by the user.

The printing apparatus according to the present
embodiment includes a system for printing the image
information and a system for printing the associated
information. First, the system for printing the image
information will be described.

The image information for a single frame stored in the
RGB image memory 6 is read out and is transferred to a YMC/γ
converter 11, where conversion from primary color system to
complimentary color system (yellow (Y), magenta (M) and cyan
(C)) and γ conversion are performed, and is then transferred
to the switch 12.

During the process of printing the image information,
the output data from the YMC/γ converter 11 is selected by
the switch 12 and is transmitted to a transfer head 14 via a
pulse wave modulation (PWM) processor 13. In the present
embodiment, the transfer head 14 is a thermal head which
serves as a print head for printing the image information on
the print medium. A printing unit is constructed of a
printing/surface coating cartridge (ribbon cartridge), which

is provided with color ink and a film sheet (transparent laminate film, etc.), a feed mechanism 15 for the cartridge, a print paper (photographic paper) transfer mechanism 16 for feeding, outputting, and transferring the paper, and a driver controller 17 (which is controlled by the CPU 3) for each mechanism. When the image is printed, the print paper is transferred by the transfer mechanism 16 and is subjected to a thermal transfer process using Y, M, and C ink ribbons, in that order, so that the image is printed thereon. Then, a film sheet is disposed over the surface of the printed image and is transferred thereon by the transfer head 14, so that the surface of the printed image is protected. Although a printing process for black (K) is not performed in the present embodiment, this process may also be performed in accordance with requirements.

Next, the system for printing the associated information will be described below. The associated information is formed on the above-described film sheet as a watermark.

In order to print the associated information obtained by the above-described information-obtaining unit, the CPU 3 is connected to a font Read Only Memory (ROM) 19, which serves as a data storage unit 18. The data storage unit 18 stores font data, which is necessary for forming characters or symbols representing the associated information on the

film sheet, or information necessary for generating the font data.

The associated information, which is to be printed on the laminate film, is converted into bitmap data by referring to the data stored in the font ROM 19 under the control of the CPU 3. Then, the obtained bitmap data is transferred to an image memory 20 for laminate printing and stored in the image memory 20. In the present embodiment, the image memory 20 has a data capacity corresponding to a single frame.

When the associated information is formed by laminate printing, the information stored in the image memory 20 is read out, processed at a γ-converter 21, and transferred to the switch 12.

Fig. 3 is a graph which schematically shows the printing characteristics in the process of transferring the laminate film. The horizontal axis shows energy applied to the transfer head, and the vertical axis shows surface glossiness (indicated by, for example, 0 to 100%). In Fig. 3, the shaded area RA shows an area where the transfer is unstable.

The laminate film is transferred on the image-formed surface of the photographic paper by the fusion thermal transfer technique. As shown in Fig. 3, when the laminate film is transferred while the energy applied to the transfer

head is changed, the surface glossiness of the laminate film
changes along with the applied energy in the area where the
transfer process can be reliably performed (in the area
outside the unstable area RA) as shown by the curve g. With
reference to the curve g, the surface glossiness is
approximately constant until the energy reaches E1, but
suddenly falls when the energy exceeds E1. Then, when the
energy is further increased, the surface glossiness stops
falling after the energy reaches E2. Thus, E1 indicates the
energy below which the surface glossiness can be ensured,
and E2 indicates the energy above which the surface becomes
matt. Accordingly, the energy is set to E2 (or to a value
close to E2) for regions corresponding to the bitmap data
stored in the image memory 20, and is set to E1 (or to a
value close to E1) for other regions. According to this
process, which is referred to as γ conversion (for example,
a data-reference type conversion using a one-dimensional
look-up table), the associated information can be formed on
the printed image as a watermark.

　　　An experiment was performed in which the energy applied
to each of 300 Dot Per Inch (DPI) heaters was changed in
sixteen steps. A constant electrifying time interval for a
single step was determined, and the energy was increased
from Step 1 to Step 16 by increasing the total electrifying
time intervals. Then, the glossiness of the obtained

surface was determined. As a result, the area in which the transfer process was reliably performed was from step 9 to step 16 (the surface glossiness in this area was 60% to 90%), and the glossiness started to fall along with the increase of the energy at step 14.

E1 changes in accordance with various conditions such as the characteristics of the film and the transfer head that are used, etc. However, when E1 is defined as the maximum value for a reliable transfer process, it can be assumed that the surface glossiness falls in a range from approximately 1.2 times E1 to 2 times E1. Accordingly, E2 is preferably set to the maximum value in this range or to a value close to the maximum value. When E2 is too close to E1, visibility of the associated information, which is formed as a watermark, is degraded, and when E2 is too high, problems of energy loss and excess heating rise. Preferably, E2 is set to an adequate value in consideration with the above-described factors.

The energy applied to the transfer head for transferring the film sheet can be controlled by selecting from a plurality of control values which are set stepwise. Although E1 and E2 shown in Fig. 3 are used as control values in the present embodiment, more than three control values may also be set. From the viewpoint of easy control, the associated information is preferably formed as a

watermark in the film sheet by making glossy regions and
matt regions, or by changing the glossiness.

The γ converter 21 performs the above-described
processes. After the image has been printed, the data
processed by the γ converter 21 (data of the associated
information) is selected by the switch 12 and transferred to
the PWM processor 13. Then, the transfer head 14 receives
the output from the PWM processor 13 as a drive signal, and
performs laminate printing. As shown in Fig. 4, the
associated information is formed in a film layer LF covering
a printed-image layer Lp merely by the difference in surface
glossiness (the region indicated by WM shows the region
where the characters, etc., are formed as a watermark).
Accordingly, the associated information is not visible when
the photographic paper is seen from the front, that is, from
the direction perpendicular to the photographic paper (the
direction shown by the arrow A), and is most clearly seen
from the angle at which the peripheral light is completely
reflected at the surface of the paper.

Accordingly, in the present embodiment, a control unit
is constructed of the CPU 3, the image memory 20 for
laminate printing, the data storage unit 18, the γ-converter
21, and the PWM processor 13. The control unit controls the
energy applied to the transfer head 14 and changes the
surface glossiness of the film sheet, and thereby forms the

characters, symbols, etc., representing the associated
information as a watermark.

In the present embodiment, the characters representing
the associated information are formed on the film sheet by
reducing the surface glossiness of the film sheet at regions
corresponding thereto (regions where the associated
information is formed). However, the characters may also be
formed in a converse manner, that is, the regions outside
the associated information may be formed as matt regions by
setting the energy to E2 and the region corresponding to the
associated information may be formed as glossy regions by
setting the energy to E1. In addition, according to the
present embodiment, the characters are formed as a watermark
by changing the surface glossiness of the film sheet.
However, properties other than the surface glossiness of the
film sheet may also be changed as long as the watermark can
be formed by changing the energy applied.

In addition, the image memory 20 dedicated for laminate
printing is provided in the present embodiment. However,
preferably, the storage unit for storing the image
information is used, so that the storage capacity thereof
can be exploited more efficiently. For example, since the
image memory 6 is provided as a storage unit for the image
information, a part of, or all of the memory area in the
image memory 6 can also be used for storing the associated

information. More specifically, after the data stored in
the image memory blocks (6R, 6G, and 6B) has been output for
printing the image, unused memory areas in the image memory
blocks (6R, 6G, and 6B) can be temporarily used as an image
memory for laminate printing. In such a case, as shown by
the dashed lines in Fig. 1, the bitmap data for forming the
associated information is transferred from the CPU 3 to the
image memory 6, and temporarily stored in a predetermined
area of the image memory 6. Then, the data is read out from
the image memory 6 and transferred to the γ converter 21.
Alternatively, the buffer memory 7 may also be used as the
image memory for laminate printing, or the data of the
associated information may be temporarily stored outside in
a recording medium and read out therefrom when the laminate
printing process is performed.

Next, image processing and associated information
processing in the printing apparatus will be described below.
In the following descriptions, a case is considered in which
the image file is JPEG compressed and the above-described
Exif date information is printed by laminate printing as the
associated information.

When a thumbnail image is included in the image file
data, an array of small images can be displayed on the image
display 10 under the command of the CPU 3, so that the user
can select the image he or she wishes to print.

Alternatively, when a file format (for example, "DPOF"
(trademark of Canon Kabushiki Kaisha)) of the image to be
printed is determined in advance, the CPU 3 checks the
contents of the image file and determines whether or not the
image information is to be printed. Of course, the user may
directly select the file and determine the image to be
printed (for example, stationary images may be shown in turn
and the user may issue a selecting command when the image
that the user wishes to print is on the display).

    In addition to the operation of selecting the image to
be printed out, a command indicating whether or not the
associated information is to be printed in the form of a
watermark may be issued to the CPU 3 via the input/operation
unit 8. In the following descriptions, it is assumed that
the command to print the associated information has been
issued.

    In the process of decompressing the JPEG compressed
image data, the CPU 3 issues a command to the JPEG
decompressor 5 in units of pixel blocks, so that the
brightness data (Y) and color difference data (Cb and Cr)
are obtained. Then, the obtained data are temporarily
stored in the buffer memory 7, and are then subjected to the
size conversion (resizing process) process and the color
conversion process, so that the RGB bitmap image data are
obtained. Then, the RGB bitmap image data are stored in the

memory blocks 6R, 6G, and 6B of the image memory 6 in accordance with the color.

The date/time information can be obtained from the Exif standard image file. As described above, the date/time information is stored in the "Exif IFD" (Exif Private Tag) as 20-byte ASCII character strings in correspondence with tag numbers 9003H and 90004H. Thus, the character string for the desired date/time information can be obtained by searching for the corresponding tag number, and the bitmap data for the obtained character string is determined by referring to the font ROM 19 and stored in the image memory 20 for laminate printing. If the tag cannot be found, or if the character string representing a date is not stored in correspondence with the tag, a process determined for such a situation is performed. For example, a message to inform the user that there is no date information may be displayed, or the user may be prompted to input the date information.

A case is considered in which a memory dedicated for laminate printing is prepared in addition to the image memory, and the memory for laminate printing has a memory area (virtual two-dimensional address area) corresponding to the pixel array of the print image. In such a case, as shown in Fig. 5, the associated information (date information) can be printed at a desired position.

Fig. 5 is a conceptual diagram showing a memory

structure in a case in which the date information is printed
at the lower right position in the print image. In this
example, it is assumed that the margin-free printout is
performed.

In the coordinate system in which the upper left corner
of the image is the origin (0,0) and X and Y directions are
the horizontal and vertical directions, respectively, the
coordinates of the lower right corner (Xmax, Ymax) are
determined in accordance with the size of the print image.

The coordinates at which characters of the character
string representing the date information are printed can be
determined on the basis of margins in the X and Y directions
(note that these margins are set for defining the printing
positions and are not the above-described margins meaning
the areas for printing the associated information thereon),
the size of the characters, and gaps between the characters.

In addition, when the bitmap font stored in the font
ROM 19 is used, the heights and widths of the characters can
be determined by setting a magnification. In Fig. 5, a part
of the contents stored in the font ROM 19 and enlarged
bitmap data for the character "A" are shown. Although fonts
other than a bitmap font may also be used, when the
associated information can be shown by using only simple
figures such as numerals, letters, symbols, etc., the bitmap
font is preferably used from the viewpoint of processing

speed, cost, etc.

The date information may be printed at, for example, a position such that the character string is adjusted to the lower right end as shown in Fig. 5. In such a case, after the ASCII character string representing the date information has been obtained, the data to be transferred to the image memory 20 is made such that the bitmap font data is adjusted to the right end in the character frame (frame for positioning the characters). Alternatively, the user may determine the position to print the associated information or select the position from a plurality of choices. In addition, with regard to the form of the date, the construction may be such that whether the year is printed in Gregorian years or Japanese years, the order in which the year, month, day, and time are printed, etc., can be determined or selected.

In the process of printing the image, the RGB data stored in the image memory 6 are subjected to optimal color conversions, so that YMC data are obtained. In addition, electrical energy applied to resistive elements provided in the thermal transfer head 14 is controlled by performing pulse width modulation, so that gradations are represented. Accordingly, a print image in which intermediate tones are reproduced can be obtained. This control process is performed for each of the color inks supplied by the feed

mechanism 15, and a full-color image is obtained by transferring the color ink on the photographic paper and forming images of three colors over one another.

The process of forming the date information in the laminate film is performed after the above-described image-forming process. In this process, the characters, etc., are formed as a watermark by changing the surface glossiness of the laminate film when the laminate film is fed by the feed mechanism 15 and transferred on the image. More specifically, a plurality of control values are set stepwise in advance, and the energy applied to the transfer head 14 for transferring the film sheet is controlled by selecting from the control values. The energy applied to the transfer head 14 is controlled such that the surface glossiness of the film sheet is made relatively low (or high) at regions corresponding to the associated information (characters representing the associate information).

The position where the associated information is formed must be set in consideration with the orientation of the image. Otherwise, there is a risk that the watermark will be formed at unexpected or undesirable positions. For example, when a photograph is taken by a camera, a landscape-oriented image as shown in Fig. 6 is obtained if the camera is held in the horizontal position, and a portrait-oriented image as shown in Fig. 7 is obtained if

the camera is held in the vertical position. Thus,
landscape-oriented images and portrait-oriented images are
stored in the same recording medium in a mixed manner.
Accordingly, unless the position and orientation of the
characters representing the associated information are set
in accordance with the orientation of the image, there is a
risk that the orientation of the image and that of the
characters will be different and the characters cannot by
seen easily.

In order to prevent such a situation, information
regarding the orientation of the image is input or selected
using the input/operation unit 8. Alternatively, the
information regarding the orientation of the image is
obtained from the attached information. Then, the position
and orientation of the associated information is set in
accordance with the orientation of the image. In the case
in which the information regarding the orientation of the
image is input or selected using the input/operation unit 8,
the image is displayed on the image display 10. The user
commands the rotation, vertical flip, etc., and determines
the orientation of the image, and then the position and
orientation of the character string representing the
associated information are determined. Alternatively, the
information regarding the orientation of the image can also
be obtained from the attached information stored in "Exif

IFD". As described above, the tag number "112H" is assigned for the orientation of the image, and the orientation of the image can be determined based on a number of the tag information (numbers 1 to 8 are used for representing eight kinds of orientations). Accordingly, in this case, the position and the orientation of the character string can be determined automatically.

In either case, the position and orientation of the character string representing the associated information such as date information, etc., are determined in accordance with the orientation of the image. Accordingly, the character string is formed along the longitudinal direction on a landscape-oriented image as shown in Fig. 6, and is formed along the direction perpendicular to the longitudinal direction (lateral direction) on a portrait-oriented image as shown in Fig. 7. In Figs. 6 and 7, the character string which is formed as a watermark is shown as if it can be seen from the front of the image for convenience. However, in actuality, it cannot be seen unless the page is tilted and the character string is seen at an angle.